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PEIZOELECTRIC SENSOR MODEL TO UNLOCK DIGITAL DOORS USING ARDUINO UNO

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Abstract: Generally, people still use a simple key system. The door opening function still uses conventional (manual) keys such as locking levers, sliding locks or rotating hinges. The widespread use of keys as a general security method often results in the loss of keys while traveling. For this reason, this research aims to maintain a home or place security system that must be protected with a knock sensor at an affordable price among the public. This system uses a knock key piezoelectric sensor, Arduino Uno. So it produces a smart door using a knock sensor, where when it is knocked the knock is automatically read by the sensor.

Keywords: knock piezoelectric sensor; arduino uno.

Abstrak: Umumnya masyarakat masih menggunakan sistem kunci yang sederhana. Fungsi bukaan pintu masih menggunakan kunci konvensional (manual) seperti tuas pengunci, kunci geser atau engsel putar. Meluasnya penggunaan kunci sebagai metode keamanan umum seringkali mengakibatkan hilangnya kunci saat bepergian. Untuk itu penelitian ini bertujuan untuk menjaga sistem keamanan rumah atau tempat yang harus dilindungi dengan sensor ketukan dengan harga yang terjangkau dikalangan masyarakat. Sistem ini menggunakan sensor piezoelektrik kunci ketuk, arduino uno. Sehingga menghasilkan pintu pintar dengan menggunakan sensor ketukan, dimana ketika diketuk otomatis ketukan itu terbaca dengan sensor tersebut.

Kata kunci: sensor piezoelektrik kunci ketuk; arduino uno.

INTRODUCTION

The development of modern technological science has now brought humans to a better civilization [1]. There are many benefits and conveniences resulting from technological develop ments in the digital revolution 4.0 era, especially with the birth of computers, the quality and effectiveness of humans at work has increased [2]. In fact, it is no longer possible for humans to be separated from these tools, because the computer field offers various conve niences to help humans complete their work, for example in mathematical calculations, databases, statistical data processing, presentations, playing games, and even computers [4].

Generally, people still use a simple key system. The door opening function still uses conventional (manual) keys such as locking levers, sliding locks or rotating hinges [3]. The widespread use of keys as a general security method often results in the loss of keys while traveling.

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One of the triggers for criminal acts is the very large differences in levels of welfare in society. There are many ways you can avoid the crime of robbery at home or in a private room, such as by hiring security guards such as security guards to stand guard. Of course this will increase monthly costs, this is where the problem starts from a weak key security system.

The application of electronic technology is one of the solutions that is considered the most relevant to implement [5]. The security system that will be created is a security system equipped with an Ar-duino microcontroller and Peizoelec-tric sensors. Arduino is an Open Source Physical Computing Platform, the word "platform" is the right choice of words, Ar-duino is not just a development tool, but can be a combination of devices, programming languages and advanced coordinates. Development Environment (IDE). IDE, a program that plays a major role in building programs, compiling them into two codes and uploading them to the microcontroller memory [6]. by utilizing a microcontroller and Peizoelectric vibration sensors, security systems can be explored using secret knock and sound methods or knock codes that can be applied to access the entrance of a house or private room. [7]. This door locking system will be efficient among the public because basically the materials or components used to make it are relatively expensive and in terms of use it is very easy and can modify the knocks that have been determined and stored in the system [8]. For this reason, this research aims to maintain a home or place security system that must be protected with a knock sensor at an affordable price among the public.

Previous research regarding the design of a computer laboratory door backed security system used IoT-based fingerprints. From the results of the analysis carried out, it can be seen that the system needed is a system that can provide convenience and assistance in providing a security system in the computer laboratory. The system was designed and built using PHP technology, Xampp as a monitoring system, website, and MySQL as a database [21].

Advanced research on conveyor belts and automatic counters based on Arduino nano using infrared sensors in the production of white bread. This prototype utilizes Arduino Nano and Arduino Nano components, Servo Motor, Ultrasonic Sensor, 20 x 4 LCDD, and conveyor drive system. It was then concluded that with this tool the effectiveness of calculating bread production would increase, as well as shorten the time for producers and workers in calculating the amount of product produced [22].

The next follow-up research will be on the design of an automatic home door opening and closing system using an Arduino Uno based e-KTP. Design and open and close the door using Arduino Uno as a circuit controller. The RFID reader used has a frequency of 13.56MHz which is attached to black acrylic with a thickness of 3 mm. It can read e-KTP IDs with a maximum distance of 1 cm. The selenoid will actively open the door lock and the servo motor will actively open the door if the e-KTP ID matches the Arduino Uno memory. Then the door will close and lock again within 15 seconds. If the door of the house is attempted to be opened with an e-KTP ID that is not registered in the Arduino memory, the buzzer will sound and the red LED will light up as an alarm and the solenoid remains in the lock position. The design is also equipped with manual

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operation using a button placed on the inside of the door, making it easier to open the door when leaving the house [23].

METHOD

This research method is used to produce peizoelectric sensor mode products using arduino uno [9].

In this arrange the analyst employments the model strategy, since this meth-od may be a strategy that's broadly used by computer program designers. The pith of this strategy is the method of creating a show into a last framework.

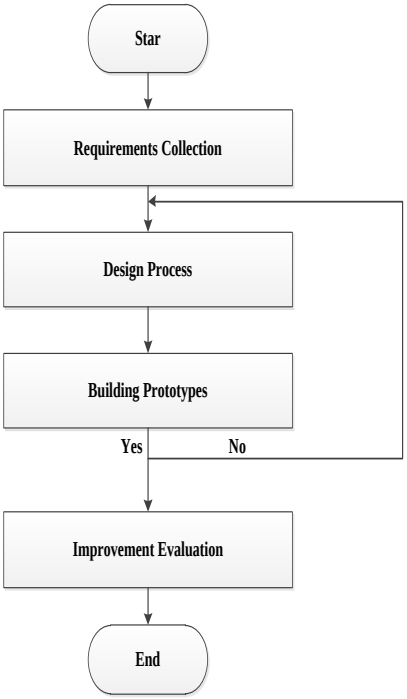

Image 1. Stages of the Prototype Method

The following tools are used to model piezoelectric sensors for digital unlocking using Arduino Uno [10].

Piezoelectric Sensors

Piezoelectric sensors are a type of sensor that uses the piezoelectric effect to detect pressure, mechanical force, or vibration. The piezoelectric sensor itself produces AC voltage [11].

Image 2. Piezoelectric Sensors Arduino uno

Arduino UNO as a controller, where the ultrasonic sensor installed above the main irrigation door sends the data received to the Arduino UNO and the servo motor acts as a driver for opening and closing the door automatically according to the data sent by the Arduino UNO [12].

Image 3. Arduino uno Door Lock

Smart door lock is a door lock whose operation can be done in an unusual way. In this case, operations can be carried out using fingerprints, passwords, taps, Bluetooth communi cation and even using the internet network [13]. The main function of the Smart Door Lock is to limit people who can access the door so that only certain people who have permission can access the door.

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Image 4. Door Lock Tool Schematic

Workflow: Detecting Vibration with Piezoelectric Sensors: Piezoelectric sensors generate voltage when they detect vibration or pressure. Rephrase, Arduino reads voltage: Arduino reads voltage from sensors via analog pins [14]. When the voltage exceeds a predetermined threshold, the Arduino interprets this as a signal to release the lock. Servo motor activated: Arduino sends a signal to the servo motor to move it to the open position (usually 90 degrees). LED indicator (optional): LED light to indicate unlocked.

Restoring lock: After a few seconds, the Arduino returns the servo to the locked position and turns off the LED.

Image 5. Tool Schematic

Relay

The main task of relays is to enable safe and reliable control of electrical equipment with low control signals [15]. Relays can separate and isolate two different circuits, allowing for safer control of high-power devices with low electronic components.

Image 6. Relay

The taking after are the stages of making a model methodIn composing equations and conditions utilizing the equa-tion as within the equation [16].

Requirements Collection

Here collects data to make a digital knocker door lock with a peizoelectric sensor using an Arduino Uno microcontroller. This really helps owners of private houses and rooms in opening the doors of private houses and rooms more practically than is usually used by the general public [17].

Prototype Design Process

At this stage of the design process the author carried out design planning and design before carrying out the process of making the "Digital Knock Key" tool [17].

Build a Prototype

In this stage builds a prototype and creates a temporary design that focuses on making a digital door lock with a peizoelectric sensor and using an Arduino microcontroller [17].

Protoptype Evaluation

At this prototype evaluation stage, we will discuss the software design that will be used by users, whether the prototype that is built meets their desires and needs, then the next stage will be implemented[17].

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RESULT AND DISCUSSION

Prototype Models

A prototype model is an initial version of a software system that is used to demonstrate concepts, design experiments and find more problems and possible solutions. Prototype systems allow users to find out how the system works.

Digital Knock Door Lock Device Model

The system illustrate of the Arduino Uno contraption on the Computerized Pound Entryway Jolt system can be done utilizing the fol-lowing steps [18]:

Interface the electric current source to the electrical control control equipment circuit.

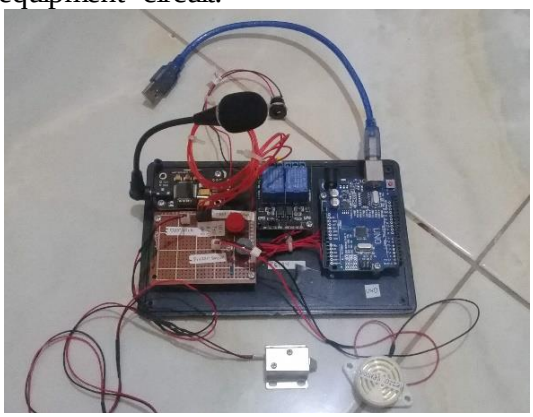

Image 7. Series Of Electrical Control Equipment

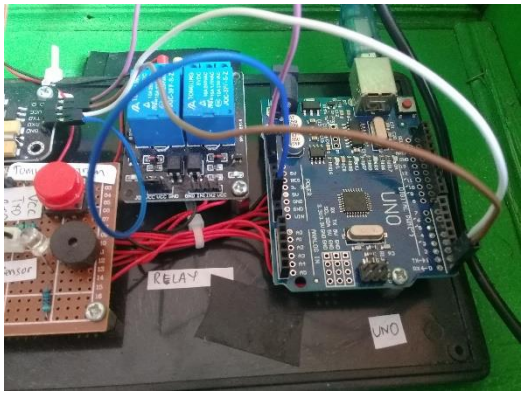

Image 8. Relay and Uno

After that the Digital Knock Door Lock will light up as will the Arduino supporting devices, the LED lights and the relay circuit.

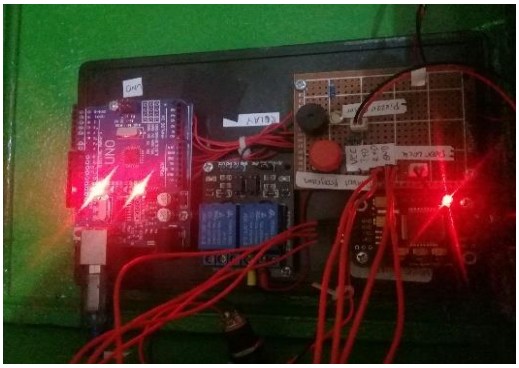

Image 9. LED Lights And Relay Circuits

Knock Sensor Testing

This test is carried out to find out whether the sensor is able to detect knocks that have been programmed in the storage carried out on the Pust Button [19]. This sensor is placed on the back of the door, so that when you knock on the door to unlock the door, this sensor will detect whether the knocking process is correct. If the tap is correct, the solenoid will open, if the tap is wrong, the LED light will flash quickly. The solenoid will not open. The Peizoelectric sensor test results are shown in:

Table 1. Knock Sensor Testing

Testing	Beat Distance	Information
1	1 Second	Open
2	2 Second	Open
3	3 Second	Open
4	4 Second	Not open
5	5 Second	Not open

Based on the sensor test, √ means the knock is correct, the Solenoid is open,

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and × means it is wrong, the LED light will flash quickly. The Solenoid is not open. System Testing using the Black-Box Method.

To test the system, the author uses the black-box testing method. This testing is carried out to decide whether the pro-gram is appropriate for utilize or not and whether it meets the anticipated needs or not.

Black-box testing could be a arrange that centers on the utilitarian articulations of the program [20]. This test case points to appear the work of the computer program and how it works. Is the input of beat and sound information running because it ought to? Hence, black-box testing permits computer program designers to ob-tain a set of input conditions that completely utilizes all useful necessities for a program.

Black-box testing tries to find botches in a couple of thingg, particularly: (1) wrong or off base capacities., (2) Interface botch. (3) execution botchthe taing after table traces the black-box.

Table 2. Black-Box Testing

Interface	Test Case	Input	Output	Conclusion
Knock	Image 3	Carry out taps accordi cording to the specified yes	Open Key	Valid

CONCLUSION

From the test results using Piezoelectric Sensors, Arduino Uno, Door Lock, Tool Schematic, and relays, a functioning smart door was produced. If the door is knocked according to the predetermined knock code, the door lock will open, if it does not match, the LED light will turn on. quickly. The door can open because by inserting each sensor, the sensor will detect vibrations due to knocking. Detected results from the Peizoelectric Sensor, the sensor will respond properly again if the command carried out is correct. The detection process for each sensor is vibration and frequency, apart from that the program has also been uploaded to each tool that will work.

BIBLIOGRAPHY

[1] Sternberg, R. J. (2022). Time bomb: How the Western conception of intelligence is taking down humanity. In Intelligence in context: The cultural and historical foundations of human intelligence (pp. 393-411). Cham: Springer International Publishing.

[2] Roring, R. S., Indrayani, N., & Safii, M. (2022). The Impact Of Artificial Neural Network (Ann) Developments For The Accountant Profession In Facing The Industrial Era 4.0 And Society 5.0. Neuroquantology, 20(10), 8502.

[3] Hs, R. G., Yahya, M., & Alqadri, M. S. (2023). Pengembangan Desain Mesin Pengisap Sampah (Doctoral dissertation, Politeknik Negeri Ujung Pandang).

[4] Leni Septiana, L. (2024). Analisis Konflik Kepentingan Dalam Penerapan E-Parkir Di Kabupaten Ponorogo (Doctoral dissertation, Universitas Muhammadiyah Ponorogo).

[5] Sulasih, E. (2024). Penggunaan Gadget Dalam Pembelajaran Siswa Kelas Viii Smp Negeri 8 Muaro Jambi (Doctoral dissertation, Universitas Jambi).

[6] Click, Jurnal J., et al. *JURNAL J – CLICK*. 2016, pp. 179–85.

[7] Eriyani, Vina, et al. *Jurnal Coding Sistem Komputer Untan Volume 06 , No 03 (2018), Hal 66-74 ISSN 2338-493X Jurnal Coding Sistem Komputer Untan Volume 06 , No 03 (2018), Hal 66-74 ISSN 2338-493X*. Vol. 06, no. 03, 2018, pp. 66–74.

[5] Fonda, Hendry Fonda, et al. "Sistem Pemetaan Penyakit Dengan Menggunakan Gis Di Dinas Kesehatan Kotamadya Pekanbaru." *Jurnal Ilmu Komputer*, vol. 6, no. 1, 2017, pp. 50–56, doi:10.33060/jik/2017/vol6.iss1.51.

[8] Handoko, Prio. "Sistem Kendali Perangkat Elektronika Monolitik Berbasis Arduino Uno R3." *Seminar Nasional Sains Dan Teknologi 2017*, no. November, 2017, pp. 1–2, jurnal.umj.ac.id/index.php/semnastek.

[9] Pramono, Sendy. *Pengendalian Robot Beroda Berbasis Arduino Uno R3 Menggunakan Koneksi Bluetooth*. Vol. 1, no. 1, 2016, pp. 12–18.

[10] Pratama, Muhammad Taufiq. "Evolusi Bahasa Pemrograman (Evolution Of Programming Language)." *Jurnal Computech & Bisnis*, vol. 8, no. 1, 2014, p. 35.

[11] Rizki, Kiki M., et al. "Implementasi Sensor Piezoelectric Sebagai Prototype Alat Musik Piano Berbasis Arduino UNO." *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer (J-PTIIK) Universitas Brawijaya*, vol. 2, no. 11, 2018.

[12] Rosmala, Dewi, et al. "Implementasi Aplikasi Website E-Commerce Batik Sunda Dengan Menggunakan Protokol SSL." *Jurnal Informatika ITENAS Bandung*, vol. 3, no. 3, 2012, pp. 58–67.

[13] Saleh, Muhamad, and Munnik Haryanti. "Rancang Bangun Sistem Keamanan Rumah Mengunakan Relay." *Jurnal Teknologi Elektro*, vol. 8, no. 3, 2017, pp. 181–86.

[14] Tristianto, Chrisantus. *Use of Waterfall Method for Monitoring and Development Systems*. Vol. XII, no. 01, 2018, pp. 8–22.

[15] J. Hutahaean, *Konsep Sistem Informasi*. Yogyakarta: Deepublish, 2015.

[16] D. Sutrisno, S. N. Gill, and S. Suseno, "The development of spatial decision support system tool for marine spatial planning," *Int. J. Digit. Earth*, vol. 11, no. 9, pp. 863–879, 2018.

[17] Ahmad, A., & Ikhlas, M. (2020). Sistem Membuka Pintu Dengan Ketukan Bernada Menggunakan Mikrokontroler Atmega328. *J-SAKTI (Jurnal Sains Komputer dan Informatika)*, *4*(2), 368-378.

[18] Pradistia, R. F., & Prasetyo, D. A. (2022). Pemanfaatan Sensor Piezoelektrik Sebagai Penghasil Sumber Energi Dengan Tekanan Anak Tangga. *Emitor: Jurnal Teknik Elektro*, *22*(1), 55-64.

[19] Mardiyansyah, Z., & Nurkholis, A. (2020). Sistem Pengontrol Irigasi Otomatis Menggunakan Mikrokontroler Arduino UNO. *Jurnal Teknologi Dan Sistem Tertanam*, *1*(1), 17-22.

[20] Hariyanto, S. (2019). Simulasi

smart door lock berbasis qr code menggunakan arduino uno pada penyewaan apartemen online. *ALGOR, 1*(1), 9-15.

[21] Prayogi, F. A. (2021). rancang bangun backend sistem keamanan pintu ruang laboratorium komputer menggunakan fingerprint berbasis iot (Doctoral dissertation, Politeknik Harapan Bersama Tegal).

[22] Widoretno, S., & Mahardika, A. M. A. F. (2024). conveyor belt dan alat penghitung otomatis berbasis arduino nano menggunakan sensor inframerah pada produksi roti tawar. Jurnal Qua Teknika, 14(1), 87-99.

[23] Manihuruk, J., & Manik, T. G. (2021). Desain sistem buka tutup pintu rumah otomatis menggunakan E-KTP berbasis Arduino Uno. Jurnal ELPOTECS, 4(2), 58-64.